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Electro convulsive therapy: Milestones in its history

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Abstract
ECT is a treatment where an electrical current is passed briefly through electrodes applied to the scalp to induce generalised seizure activity. This article explores the origins and developmental milestones of ECT, examines the literature on the history of ECT and concludes with the author's work experiences.

Key words
ECT, electro convulsive therapy, history, practice, treatment

Introduction

This year marks 80 years since electro convulsive therapy (ECT) was first used as a treatment in psychiatry. ECT is an emotive subject for service users and practitioners alike, with varying opinions of its position in current psychiatric practice.

This article examines the origins and developmental milestones of ECT, explores the literature relating to the history of ECT and concludes with our own work experiences.

Before embarking on the history of ECT, it is beneficial to start with a description of current ECT practice in the UK. We accept that we have not captured all the evidence in this work.

ECT explained

ECT is a treatment where an electrical current is passed briefly through electrodes applied to the scalp to induce generalised seizure activity.

The procedure is carried out under general anaesthetic in the UK with the use of a muscle relaxant. ECT electrodes can be placed on both sides of the head (bilateral ECT), or on one side of the head (right unilateral) (NICE, 2003). In certain circumstances, bifrontal may be used (Kellner et al, 2010).

ECT should be considered for severe depression that is life threatening or where a rapid response is required or where other treatments have failed (NICE, 2009). ECT should not be used routinely in moderate depression but could be considered if there has been no response to multiple drug treatments and psychological treatments (NICE, 2009).

ECT may be considered for treatment of a prolonged or severe manic episode and in catatonia (NICE, 2003). The consensus group for ECT concluded that ECT should be considered as a fourth line option for patients with schizophrenia for whom Clozapine had already been proven ineffective or intolerable (Scott, 2005).

Clinical indications for the use of ECT should be based on a thorough documented assessment of harms risk and potential benefits to the individual. These include risks relating to anaesthesia, current co-morbidities, anticipated adverse events particularly cognitive impairment and the risks of not having treatment.

This paper contextualises the history and development of ECT. The use of language in the paper is from evidence of the period cited to encourage reader reflection on the use and evidence base of ECT.

Historical context

The early 20th century witnessed a major revolution in the understanding and treatment of mental diseases (Sabbatini, 1998). New treatments developed for the treatment of 'dementia praecox', later to become known as schizophrenia.

Treatments were pioneered throughout Europe by a number of individuals working in psychiatry independent of each other's developments. Sabbatini (1998: 1) suggests that 'until then people with psychoses were usually locked away in asylums, receiving only limited custodial care and sometimes social support, with practically no effective therapeutic options left to the alienist, as psychiatrists were called then'.

Other historical treatments

In 1917 Julius Wagner-Jauregg (1857-1940), an Austrian professor in psychiatry and nervous diseases, introduced malarial therapy to treat individuals with 'general paralysis of the insane' caused by advanced neuro-syphillis. Jauregg was the first researcher to pursue the link between fever and mental diseases, and in 1927 he was awarded the Nobel Prize in medicine (Sabbatini, 1997/98)

Manfred Joshua Sakel (1900-1957), an Austrian neurophysiologist and psychiatrist, introduced insulin coma therapy in Vienna in 1927 to treat schizophrenia (Stafford-Clark, 1952).

Egas Moniz (1874-1955), a Portuguese neurologist and regarded as the founder of psychosurgery, developed the surgical procedure prefrontal leucotomy in 1935

(Gross and Schafer, 2011).

The late 1920s and early 1930s saw the development of 'convulsive therapy'. Note at this point the word 'electro' does not appear. Convulsive therapy, which was thought to be the first effective treatment in schizophrenia, was introduced by Ladislas J Meduna (1896-1964). Meduna was a Hungarian neurologist and neuropathologist who studied medicine in Budapest from 1914 to 1921. His studies were interrupted by military service in the Italian front from 1915 to 1918 (Sabbatini, 1998).

Meduna's idea of convulsive therapy was based on frequent observation upon patients with schizophrenia, some of whom displayed catatonia, and would temporarily lose their psychotic symptomatology after spontaneous seizures whatever their cause. Such spontaneous seizures may occur after alcohol withdrawal, infection or head injury (Kalinowsky, 1986).

Colleagues of Meduna, Drs Nyiro and Jablonsky in 1929, observed that patients with epilepsy who also had psychotic features became lucid during periods of frequent fitting (McCrae, 2006). Nyrio concluded that epilepsy occurred less frequently in conjunction with schizophrenia than could be accounted for by chance alone (Stafford-Clark, 1952).

Meduna was examining human post mortem specimens while working at the Hungarian Psychiatric Hospital in Budapest in the 1930s. He observed that the brains of patients with schizophrenia had fewer than the normal number of neuroglia (glial cells) and that the brains of patients with epilepsy had markedly more. Neuroglia are branched cells in the central nervous system that provide a supporting and communicating network for the neurons, the brain cells for thought, memory emotion and action (Fink ,1999). Meduna postulated that the induction of seizures in patients with schizophrenia would increase the concentration of glia and relieve features of their illness (Fink, 1999).

Meduna believed there was a biological antagonism between these two diseases of the brain (Sabbatini, 2002). This theory has not stood the test of time, but Meduna proceeded to test its practical implications by producing epileptic fits patients with schizophrenia (Stafford-Clark, 1952).

Meduna continued to experiment with various substances for their seizure-inducing potential in animals, settling on intramuscular injections of camphor in oil. Meduna injected the substance into animals and after 15 to 60 minutes produced a grand mal convulsion that did not incapacitate or kill the animal. The technique he postulated may have applications to humans (Fink, 1999).

In the hospital where Meduna worked, the belief of many of the doctors was that dementia praecox was an inherited genetic disorder and as such was not treatable. Fearing his work would be criticised, Meduna moved his research activities to a state hospital for the long-term mentally ill at Li-potmezo, near Budapest (Fink, 1999).

Fink (1999) identifies Meduna's first patient was a man called Zolten, who aged 33 had been mute, psychotic and withdrawn for four years. His diagnosis was dementia praecox of the catatonic type. On 23 January 1934 Meduna induced a seizure in Zolten using camphor. After 45 minutes Zolten had a classical epileptic attack that lasted 60 seconds. Zolten recovered without harm and continued to have injections of camphor at intervals of three to four days. This followed the pattern of treatment of malarial therapy for neuro syphilis at the time.

Fink (1999) reported that two days after the fifth injection, for the first time in four years Zolten got out of bed, began to talk, requested breakfast, dressed himself without help and retained environmental interest. Zolten was surprised when he was told he had been in hospital for four years. Zolten had three further injections and returned home. Meduna treated a further five patients with camphor, and each of them improved.

Meduna continued to treat patients but changed from camphor oil to Metrazol (Cardiazol). He found this easier to use, the seizure was more immediate and predictable. By 1937 Meduna had treated 110 patients and he reported relief and remission of mental illness in 53 of them.

Convulsive therapy was widely adopted at the time, with some suggesting that it was far more effective in the treatment of depressive illness rather than schizophrenia for which it had originally targeted. The greatest value seemed to be in the treatment of involution melancholia that had previously been unresponsive to other treatments, which began to respond within a matter of days or weeks in the most dramatic way (Stafford-Clark, 1952).

However, there were drawbacks in the use of Cardiazol. There was an intense dread experienced by patients between injection and seizure. Treatment was not pleasant causing discomfort as the drug began to take effect and patients felt physically ill afterwards. The seizures were sometimes violent, causing bone fractures, joint dislocations and hairline fractures to the spinal vertebrae (McCrae, 2006). Seizures induced by camphor and Cardiazol were equally effective, which suggested that the therapy was inherent in the seizure, not in the mode of induction. This conclusion led directly to seizures induced by electricity (Fink, 1999).

Development of ECT

ECT was developed by Professor Ugo Cerletti and Dr Lucio Bini. Ugo Cerletti (1877-1963) was the son of an Italian agricultural engineer. He was an Italian neurologist and chair of the Department of Mental and Neurological Diseases at the University of Rome in 1935. (Sabbantini, 1997/98). Lucio Bini (1908-1964) was an Italian psychiatrist and Professor at the University of Rome in 1935.

As a neurologist Cerletti was particularly interested in the study of epilepsy. He carried out experiments on animals, especially dogs, repeatedly inducing epileptic seizures using an electric current of 125 volts. During this experimentation, he became aware of convulsive therapy for schizophrenia and began treatment-using Cardiazol.

He theorised on the possibilities of using 'electroshock', as he called it, on humans (Bollorino et al, 2012). Cerletti visited a Rome abattoir where pigs were slaughtered. Before slaughter the pigs were electrocuted using a large pair of

pincers held on their heads. Electricity of 70 to 80 volts was delivered through the pincers, causing the pig to become unconscious and have a generalised convulsion.

Cerletti then began to conduct his own experiments using dogs, passing an electrical current of 125 volts (alternating current) through the head for a fraction of a second causing a seizure. Reportedly this activity did not cause any significant problems or endanger life. He theorised that applying an electrical current in a similar way in humans without much danger could be effective (Bollorino et al, 2012).

First clinical use of ECT

Under Celettis' instruction Bini built a machine to deliver brief electric shocks to humans. It became known as the Bini-Cerletti electro shock apparatus (Aruta, 2011). The following case study was reported as an early example of efficacy:

A man in his 40s was found wandering at a railway station from one train to another without a ticket. He was acting in a strange way, answering questions in a strange language which was incomprehensible. He was admitted to hospital suffering from hallucinations and delirious ideas about being under some kind of influence. Apart from that he was lucid and well orientated, but apathetic and lacking in willpower. On the ward he was reported as always lying contentedly on his bed murmuring, and was diagnosed as having schizophrenia (Bollorino et al, 2012). It was reported that a few years earlier he had responded to treatment with Cardiazol in the Medical Academy of Rome (Fink 1999).

In April 1938 the first 'electroshock', as it was then called, was delivered. Having fixed two electrodes soaked in a saline solution with an elastic band to the frontal parietal area, 80 volts of electricity was delivered for one-fifth of a second. Following an initial stiffening of his muscles the patient fell back onto the bed without losing consciousness. A further electroshock of 110 volts was given for one-fifth of a second. The patient immediately had a very brief general spasm and epileptic seizure. The seizure went on for some time, with the patient gradually regaining consciousness. The patient then woke up and smiled. When asked what had happened to him he thought he may have been sleeping. He went on to have 11 electroshocks and had a complete remission of his symptoms and was discharged in June 1938 (Bollorinio et al, 2012).

After 10 to 20 treatments on alternate days the improvement in most of the patients was startling. One of the unexpected treatment benefits was that it provoked retrograde amnesia, or memory loss of events immediately anterior to the shock. Patients had no negative feelings towards the treatment (as had happened with Metrazol), and was considered to be reliable, controllable and less dangerous to the patient than Metrazol (Sabbatini, 1998). It is noteworthy that these are single case report examples and form lower hierarchal levels of research evidence.

Use of ECT in the UK

ECT was introduced to the UK in 1939 by Lothar Kalinowsky, a colleague of Cerlettis. He demonstrated ECT at the Burden Neurological Institute and published in The Lancet in December 1939 (Kalinowsky, 1939). Also in 1939 and independently of Kalinowsky, Edward Golla, the director of the Burdon Neurological Institute in Bristol, and his assistant Grey Walter commissioned a company Edison Swan Electric to build an ECT machine. They treated five psychotic patients from Barnwood House Hospital in Gloucester (Shorter, 2016). They also published in The Lancet in December 1939.

ECT soon became more popular than Cardiazol treatment in mental hospitals in the UK (McCrae, 2006). Brain and Strauss (1945) suggested that ECT was especially useful in the treatment of affective psychosis and the therapeutic value in schizophrenia was reported as limited.

Some psychiatrists thought that ECT should be restricted to depression (Allen, 1949). Hemphill and Grey Walter (1941) report results following ECT for patients for patients with schizophrenia, mania, depression and involutional melancholia.

It was also used in treatment of people who had suffered war neurosis and admitted to neurosis centres or mental hospitals with severe depression (Sargent, 1942). Views on ECT were generally positive in the early years of its use. Most patients received treatment 2-3 times a week or occasionally daily (Hemphill and Walter, 1941). Some psychiatrists experimented with more intensive treatment regimens. One of these psychiatrists was Robert Russell, who later formed a company called Ectron Ltd to manufacture ECT machines (Easton 2010). These machines were used extensively in the UK (Pippard, 1992).

Modified and unmodified ECT

ECT was given without the use of muscle relaxant or anaesthesia until the early 1950s (termed 'unmodified ECT'). Psychiatrists in the 1940s experimented with curarae to try to modify convulsions that were sometimes so intense they caused long bone fractures or dislocations. By 1951 succinylcholine was being used as an alternative to curarae, which was deemed safer. In addition, a short-acting anaesthetic administered to prevent the terrifying feelings of not being able to breathe, with the muscle relaxants known as 'modified ECT' (Kiloh et al, 1988). By 1957 some hospitals in the UK were still not using modified ECT.

A patient named Bolam received ECT at Friern Hospital London unmodified. Bolam sustained bilateral hip fractures and he sued the hospital (Bolam v Friern Hospital Management Committee, 1957). Bolam was a voluntary patient at a psychiatric unit. He agreed to undergo ECT, was not given any muscle relaxant, and was not restrained during the procedure. He flailed violently during the procedure, and suffered serious injuries. He sued the hospital for compensation. He argued it had been negligent by not giving muscle relaxants, not restraining him and crucially not warning him about the risks involved. It was common medical practice at the time not to warn patients of the risks unless they asked. This was a landmark ruling for medical negligence claims. The case caused great debate about ECT

practice and by the early 1960s all patients were receiving a general anaesthetic and muscle relaxant (Easton, 2010). Bolam reasonableness has however been revised in the Supreme Court decision of Montgomery v Lanarkshire Health Board (2015). Readers may also consider the case of Bolitho regarding medical risks and benefits that are a matter of clinical judgement and decisions made should withstand logical analysis (Bolitho v City and Hackney Health Authority, 1996). The Bolam and Bolitho cases still stand but can be challenged, if it can be satisfied that the body of expert medical opinion cannot be logically supported.

Unilateral ECT

Bilateral ECT was the most common form of electrode placement in ECT. However, in a paper delivered to a quarterly meeting of the Royal Medico-Psychological Association at Bristol in May 1957, psychiatrists Lancaster, Steinert and Frost, who were working in Bristol and Chester, explained the technique of 'unilateral ECT'. This was in relation to memory loss that was a major side-effect of bilateral ECT.

They concluded that unilateral ECT was of use in elderly patients with severe arteriosclerosis who were depressed and had nutritional difficulties. Patients with superior intelligence, young patients (under the age of 40) or presented with predominantly neurotic features and depressed sufficiently may warrant ECT (Lancaster et al, 1958). Unilateral ECT is still used as a method of delivering ECT in current practice, although the parameters mentioned above have changed somewhat. ECT continued to be used as a treatment in psychiatry in the 1960s and 1970s.

Perrin et al (2012) suggest that although ECT has been practised for over 70 years the underlying mechanisms of action remain unclear. A study was undertaken in a group of nine patients where MRI scans were used along with a unique data-driven analysis approach to examine functional connectivity within the brain before and after ECT. The findings reported added weight to the emerging hyper connectivity hypothesis in depression and supported the proposal that increased connectivity may constitute both a biomarker for mood disorder and a potential therapeutic target.

Reflections on practice and standards

My first memories of witnessing ECT were in the early 1970s (writes Colin Jones). ECT was administered on a ward, which was of the Nightingale style. Patients would lie on the top of the beds with their heads facing into the middle of the ward, and the beds would be screened. About half an hour before treatment subcutaneous atropine would be given. My memory is that the patient considered this to be the worst part of the whole ECT treatment. Atropine was administered to dry up secretions (no longer used in this regard) and was likened to a bee sting.

The ECT team, consisting of a psychiatrist, an anaesthetist and nurses, would then start at the top of the ward and treat patients in turn. Brietal (Methohexitone) was the anaesthetic of choice and Brevidil-E (Suxethonium chloride) the muscle relaxant. The ECT machine in use was the Ectron. The patient was placed in the recovery position following treatment and allowed to wake naturally. Physical observations including temperature, pulse, respirations and blood pressure were taken at intervals. When able the patients were escorted to the day area of the ward and offered refreshments before returning to their respective wards. In 1978 I moved to a purpose-built newly commissioned psychiatric unit. Within it was a dedicated ECT suite with a waiting area, pre- treatment room, treatment room and a 12-bed recovery area.

Concerns were expressed by clinicians and the general public relating to various aspects of ECT. In 1977 The Royal College of Psychiatrists issued a memorandum on the use of ECT. It dealt with three key areas: a review of the scientific evidence of the effectiveness of ECT and of any adverse effects, recommendations about the standards to be observed in the administration of ECT, and the medico-legal problems of giving this treatment. (Royal College of Psychiatrists, 1977)

Following this report a survey of ECT practice in Britain was carried out for the Royal College of Psychiatrists (Pippard and Ellam, 1981). A questionnaire was sent to all members of the college, to all consultants in psychiatry and to all doctors in training. A 95% response rate was achieved.

A question was asked regarding the college's memorandum on ECT in 1977. Some 91% of respondents thought it had given inadequate guidance on how to give ECT. Respondents were critical of the insufficient detail provided, said there was not enough importance placed on staff training, and cited inadequate information on consent procedures.

Another questionnaire on how ECT was given was sent to 347 ECT clinics (90% of the total clinics operational). Visits were made to 180 of these and ECT was observed in 101 of them. The survey

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sought doctors' opinions, how ECT was given, consent and responsibility, the type of ECT machine used, anaesthesia, staff, techniques of administration, and description of clinics. The recommendations included:

- Guidance on the way ECT should be administered.
- One consultant psychiatrist should take full responsibility for the ECT clinic, teaching and training.
- The physical conditions under which ECT is given should be reviewed.
- Guidance on the machines used.
- Advice on clinical decisions.

A further survey was conducted by Pippard in 1991, which was restricted to the North East Thames and East Anglian regions. This included 35 NHS hospitals and five private clinics. He reported that since 1981 there had been much improvement in the physical conditions where ECT was given and in anaesthetic practice. Nursing was good or excellent in the majority of clinics (Pippard 1991).

Development of practice standards

The National Association of Lead Nurses in ECT (NALNECT) was formed in 2002. This group of nurses working in ECT represented nurses working across ECT departments within England, Northern Ireland and Wales (the Scottish equivalent is the Scottish ECT Accreditation Network (SEAN)) The aims of NALNECT are to:

- Provide expert knowledge, information and advice on all matters relating to ECT practice.
- Provide a forum for the provision of evidence-based practice.
- Promote the provision of special interest groups and to enable every ECT clinic to be represented. The special interest groups run regionally throughout the country.
- To work collaboratively with the ECT Accreditation Service (ECTAS).
- To facilitate and promote ECT nurse education.
- Network with the Royal College of Nursing, Royal College of Psychiatrists, the Scottish Audit Network and other appropriate national bodies.

ECTAS was established in 2003 to promote better standards of practice in ECT services in England, Wales, Northern Ireland and the Republic of Ireland. ECTAS is managed by the Royal College of Psychiatrists' centre for Quality Improvement and works in partnership with the Royal College of Anaesthetists, the Royal College of Nursing and service users. The best available evidence informs the ECTAS model standards to encourage clinics to improve continuously (ECTAS, 2018). Readers are encouraged to visit www.rcpsych.ac.uk/quality/qualityandaccreditation/ectclinics/ectas/ectasstandards.aspx.

Nurse-administered ECT

Nurse-administered ECT is a more recent development. ECT has traditionally been administered by medical staff assisted by nurses. During a global telephone conference with participants from Canada, the US, New Zealand and Australia in January 2012 the concept of nurse-administered ECT was discussed. This evoked lively discussion in the UK and globally. The issue was raised at the special committee of the Royal College of Psychiatrists, which then gave permission for four pilot sites in the UK.

Since then nurse-administered ECT has been agreed by the Nursing and Midwifery Council, the Royal College of Psychiatrists and individual NHS trusts. The Royal College of Nursing does not have a specific view on nurse administered ECT, but does support advance nursing practice (Leyden and Cornish, 2015).

Conclusion

This paper has sought to outline the history and development of ECT to encourage the reader to reflect on mental health practice. We accept this may evoke different feelings from the mental health workforce, and as nurses we should always question the evidence base to inform our practice. Patients must be at the centre of decision making and deserve the best possible evidence.

Although ECT use was initially developed from single patient case study designs, recently there have been random controlled trials that offer higher forms of evidence, which robustly support the efficacy of ECT. This is particularly in patients who are severely ill and this can be life-saving (Kerner and Prudic, 2014).

The development of relatively recent national standards is welcome and ensures that the practice of ECT is consistent across different centres with measurable outcomes. ■

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